

Attorney Docket No.: 0400204D

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**REMARKS**

Prior to the present response, claims 30-32, 35, 36, 38, 41-43 and 46-54 were pending in the present application, claims 1-29, 33, 34, 37, 39, 40, 44, and 45 having been canceled by previous amendment, and claim 48 having been unilaterally withdrawn by the Examiner. No claims are amended by the present response. However, as explained below, Applicants respectfully submit that claim 48 is properly pending in the present application. Thus, claims 30-32, 35, 36, 38, 41-43 and 46-54 remain in the present application. Applicants respectfully request reconsideration and allowance of pending claims 30-32, 35, 36, 38, 41-43 and 46-54 in view of the following remarks.

**A. Examiner's Unilateral Withdrawal of Claim 48**

The Examiner has unilaterally withdrawn claim 48, asserting that the claim drawn to a non-elected species. See page 2 of the 2 of the Non-Final Office Action dated August 25, 2010 (hereinafter "Office Action"). For the reasons presented below, Applicants respectfully submit that claim 48 is properly drawn to the elected species.

In the previous Amendment and Response to Office Action filed July 23, 2010, Applicants elected the species characterized by the Examiner as corresponding to the embodiment shown by Figures 1-8 of the present application. Referring, for example, to Figure 4 corresponding to the elected species, in addition to the features recited by independent claim 41 from which claim 48 depends, claim 48 adds the features "an insulated trench formed in said semiconductor die" (e.g., either of trenches 60 or 61

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formed in semiconductor die 30 and lined by respective gate insulations 70 and 71), "said insulated trench extending from said first major surface towards said highly doped substrate" (e.g., either of insulated trenches 60 or 61 extending towards P+ substrate 50), "and a polysilicon gate residing entirely within said insulated trench" (e.g., either of conductive polysilicon gates 75 entirely within insulated trenches 60 and 61). *See* page 5, line 12 through page 6, line 4 of the present application. Because each feature introduced by claim 48 is shown by Figure 4 corresponding to the species elected by Applicants, Applicants respectfully submit that claim 48 is properly drawn to the elected species. Accordingly, reconsideration and reversal of the Examiner's unilateral withdrawal of claim 48 is respectfully requested.

**B. Rejection of Claims 30-32, 35, 36, 38, 41-43, 46, 47, and 49-54 under 35 U.S.C. §112, first paragraph**

The Examiner has rejected claims 30-32, 35, 36, 38, 41-43, 46, 47, and 49-54 under 35 U.S.C. §112, first paragraph, as failing to comply with the enablement requirement. *See* page 2 of the Office Action. Specifically, the Examiner asserts that there is no support in the drawings and no adequate description in the disclosure for "a conductive path from said first power electrode to said second power electrode includes at least one vertical component oriented substantially perpendicular to said first major surface," as recited in independent claim 30, "a conductive path from said source electrode to said drain electrode includes at least one vertical component oriented

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substantially perpendicular to said first major surface,” as recited in independent claim 41, and “a conductive path from said first power electrode to said second power electrode includes at least one vertical component in said semiconductor die,” as recited in independent claim 50. *Id.* at pages 2-3.

However, Applicants respectfully submit that support for such limitations is found in at least Figures 7 and 8 of the present application. Sinkers 90 in Figure 7 and conductive polysilicon 92 in Figure 8 comprise vertical components which may comprise metal or conductive polysilicon. *See* page 7, line 6 of the present application. In addition, a circuit may travel from source electrode 31 “upwardly (through regions 90 or 92) to drain electrode 31,” addressing all of the Examiner’s objections under 35 U.S.C. §112, first paragraph. *See* page 7, line 13 of the present application.

Thus, Applicants respectfully submit that claims 30-32, 35, 36, 38, 41-43, 46, 47, and 49-54, in their present form, are enabled by the disclosure provided in the present application, and are in full compliance with the requirements imposed by 35 U.S.C. §112, first paragraph. Accordingly, Applicants respectfully request withdrawal of the rejections applied against claims 30-32, 35, 36, 38, 41-43, 46, 47, and 49-54 under 35 U.S.C. §112, first paragraph.

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C. Rejection of Claims 30-32, 35, 36, 38, 41-43, 46, 47 and 49-54 under 35

U.S.C. §112, second paragraph

The Examiner has rejected claims 30-32, 35, 36, 38, 41-43, 46, 47, and 49-54 under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regards as the invention. *See* page 3 of the Office Action.

The Examiner objects to “a conductive path from said first power electrode to said second power electrode includes at least one vertical component oriented substantially perpendicular to said first major surface,” as recited in independent claim 30, “a conductive path from said source electrode to said drain electrode includes at least one vertical component oriented substantially perpendicular to said first major surface,” as recited in independent claim 41, and “a conductive path from said first power electrode to said second power electrode includes at least one vertical component in said semiconductor die,” as recited in independent claim 50, as being indefinite. *See* page 4 of the Office Action. More specifically, the Examiner asserts that it is unclear as to how the respective electrodes have a vertical component. *See id.*

Applicants respectfully submit that independent claims 30, 41, and 50 state that the respective conductive paths, not the respective electrodes, include a vertical component. The references to electrodes are a part of the prepositional phrase “from said first ... electrode to said second ... electrode” which modifies “conductive path.” Thus, the “conductive path ... includes at least one vertical component” rather than the respective

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electrodes. As previously discussed, sinker diffusion 90 in Figure 7 and conductive polysilicon 92 in Figure 8 may depict "at least one vertical component." *See also* page 7, line 13 of the present application.

The Examiner objects to the limitation of "said diffusion region," as recited in independent claims 30 and 41, as being unclear as to whether said diffusion region is the same as "at least one diffusion region of a second conductivity type" recited earlier in the same claim. *See* page 4 of the Office Action. However, Applicants respectfully submit that in reading the plain language of independent claims 30 and 41, "said diffusion region" must refer to "at least one diffusion region of a second conductivity type" as there is no other previously discussed diffusion region in each respective claim.

The Examiner objects to the limitation of "said first and second solder balls," as recited in claims 31-32 and 42-43 as being unclear as to whether they refer to the same elements recited earlier, or different elements. *See* page 4 of the Office Action. However, Applicants respectfully submit that in reading the plain language of dependent claims 31-32 and 42-43, "said first and second solder balls" must refer to the same elements recited earlier as there are no other previously discussed solder balls in each respective dependent claim and each respective independent claim upon which claims 31-32 and 42-43 depend.

The Examiner objects to the limitation of "a highly doped region of said first conductivity type, said highly doped region in contact with a first power electrode," as recited in independent claim 50, as being unclear as to the structural relationship between

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the highly doped region of said first conductivity type, the first power electrode, and the claimed device. *See* page 4 of the Office Action. However, Applicants respectfully submit that in viewing the scope of claim 50 as a whole, one possessing ordinary level of skill in the art would not find such language in claim 50 as unclear. For example, terms such as “semiconductor die,” “layer ... formed over ... substrate” and “P/N junction” make clear to one of ordinary skill as to the general structure of the limitations of claim 50. In addition, independent claim 50 does not specify the formation of a single particular structure between the highly doped region of said first conductivity type, the first power electrode, and the claimed device.

The Examiner objects to the limitation of “a high conductivity region connecting said highly doped substrate with a second power electrode formed,” as recited in independent claim 50, as being unclear as to which element is formed and the structural relationship between the second power electrode and the claimed device. *See* pages 4-5 of the Office Action. Applicants respectfully submit that such language in claim 50 is not unclear. In reading the plain language of claim 50, “formed” immediately follows and modifies “second power electrode,” thus stating that the second power electrode is formed. In addition, as previously discussed, one possessing ordinary skill in the art would not find the language of claim 50 as unclear. Again, independent claim 50 does not specify the formation of a single particular structure between the second power electrode and the claimed device.

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Thus, Applicants respectfully submit that claims 30-32, 35, 36, 38, 41-43, 46, 47, and 49-54, in their present form, are fully compliant with the requirements set forth in 35 U.S.C. §112, second paragraph. Accordingly, Applicants respectfully request withdrawal of the present rejection of claims 30-32, 35, 36, 38, 41-43, 46, 47, and 49-54 under 35 U.S.C. §112, second paragraph.

**D. Rejection of Claims 30, 35, 38, 41, 46, 47, 49, 50, and 53 under 35 U.S.C.**

**§ 102(b)**

The Examiner has rejected claims 30, 35, 38, 41, 46, 47, 49, 50, and 53 as unpatentable under 35 U.S.C. § 102(b) for purported anticipation by Japanese Patent Document 10-313010 by Shoji et al. (hereinafter "Shoji"). *See* page 5 of the Office Action. For the reasons discussed below, Applicants respectfully submit that the present invention, as defined by independent claims 30, 41 and 50, is patentably novel and inventive over Shoji.

The Examiner asserts that Shoji discloses a conductive path between electrodes which includes "at least one vertical component in said semiconductor die," as required by independent claims 30, 41, and 50, but fails to give supporting detail. *See* pages 6-7 of the Office Action. Applicants respectfully submit that Shoji fails to disclose a conductive path including "at least one vertical component" as required by independent claims 30, 41, and 50.

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In Figure 4 of the present application, drain metal 32 is shown as contacting an upwardly extending portion of P+ substrate 50. *See also* page 7, lines 1-6 of the present application. However, the present application teaches forming a vertical component to contact drain metal 32 with p+ substrate 50. *Id.* In Figure 7, sinker diffusion 90 is formed downwards from the surface, whereas in Figure 8, a trench 91 is etched downwards from the surface and subsequently filled with a metal or conductive polysilicon 92. *Id.* As seen in Figures 7 and 8, sinker diffusion 90 and conductive polysilicon 92 form vertical components, which extend below at least junction receiving layer 51. Current may flow from source electrode 31, through source regions 53, 51 and 50, laterally through P+ substrate 50 and upwardly through sinker diffusion 90 or conductive polysilicon 92 to drain electrode 31. *See id.* at page 7, lines 11-14. Thus sinker diffusion 90 or conductive polysilicon 92 may comprise at least one vertical component as required by independent claims 30, 41, and 50.

In contrast to the present application, Shoji fails to disclose a vertical component within a conductive path. None of the Figures of Shoji depict a vertical component. However, assuming the Examiner's assertions that N+ board 11 of Shoji corresponds to a "highly doped substrate," N+ board 11 may correspond to P+ substrate 50 of the present application. Similar to P+ substrate 50 in Figure 4 of the present application, N+ board 11 is depicted in Figure 9 of Shoji as extending upwards toward an electrode. N+ board 11 directly contacts aluminum wiring 6. *See* Figure 9 of Shoji. However, Shoji fails to disclose or suggest a vertical component similar to sinker diffusion 90 or conductive



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polysilicon 92 of the present application. Thus, Shoji fails to disclose or suggest the "vertical component" as required by independent claims 30, 41 and 50.

Thus, for all of the reasons set forth, Applicants respectfully submit that at the time the present invention, as defined by independent claims 30, 41 and 50 was made, the invention was neither anticipated by, nor would have been rendered obvious to one of ordinary skill in the art in light of, the disclosure provided by Shoji. Consequently, Applicants respectfully assert that the invention described by independent claims 30, 41 and 50 is patentably novel and inventive over Shoji. As such, claims 35 and 38 depending from and further limiting patentable independent claim 30, claims 41, 46, 47, and 49 depending from and further limiting patentable independent claim 41, and claim 53 depending from and further limiting patentable independent claim 50, are also patentably novel and inventive over Shoji for at least the reasons discussed above, and also for the additional limitations contained in each dependent claim.

**E. Rejection of Claims 31, 32, 36, 42, 43, 51, 52, and 54 under 35 U.S.C. § 103(a)**

The Examiner has rejected claims 31, 32, 36, 42, 43, 51, 52, and 54 as unpatentable under 35 U.S.C. § 103(a) for purported obviousness over Shoji in view of U.S. Patent Number 6,117,299 to Rinne et al. (hereinafter "Rinne"). See page 8 of the Office Action. However, as discussed above, Applicants respectfully submit that the present invention, as defined by independent claims 30, 41 and 50, is patentably

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distinguishable over Shoji. As such, claims 31, 32, and 36 depending from and further limiting patentable independent claim 30, claims 42 and 43 depending from and further limiting patentable independent claim 41, and claims 51, 52, and 54 depending from and further limiting patentable independent claim 50 are also patentably distinguishable over Shoji, and Shoji in combination with any other cited references, such as Rinne, for at least the reasons presented above and also for the additional limitations contained in each dependent claim.

**F. Rejection of Claims 30, 35, 38, 41, 46, 47, 49, 50, and 53 under 35 U.S.C. § 103(a)**

The Examiner has rejected claims 30, 35, 38, 41, 46, 47, 49, 50, and 53 as unpatentable under 35 U.S.C. §103(a) for purported obviousness over U.S. Patent Number 6,831,331 to Kitamura et al (hereinafter "Kitamura"). See page 10 of the Office Action. For the reasons discussed below, Applicants respectfully submit that the present invention, as defined by independent claims 30, 41 and 50, is patentably distinguishable over Kitamura.

The Examiner asserts that Kitamura discloses a conductive path between electrodes which includes "at least one vertical component in said semiconductor die," as required by independent claims 30, 41, and 50, but fails to give supporting detail. See pages 11-12 of the Office Action. As previously discussed, the present application teaches forming sinker diffusion 90 or conductive polysilicon 92 in order to complete the

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conductive path from one electrode to another. *See* page 7, lines 1-14 of the present application.

In contrast to the present application, Kitamura teaches away from using vertical components to complete a conductive path between electrodes. Although current may flow vertically through semiconductor regions 226a, 226b, and 226c in Figure 17 of Kitamura, Kitamura teaches using semiconductor regions 226a-c for a surge current. *See* column 6, lines 37-44 of Kitamura. Since Kitamura is concerned with absorbing a surge current, Kitamura teaches discharging a surge current through semiconductor regions 226a-c, which “define a surge current path.” *See* column 6, lines 15-19 of Kitamura. As such, semiconductor regions 226a-c are not part of a conductive path from one electrode to another. Thus, Kitamura fails to disclose the “vertical component” as required by independent claims 30, 41 and 50.

Thus, for all of the reasons set forth, Applicants respectfully submit that at the time the invention defined by independent claims 30, 41, and 50 was made, the invention would not have been obvious in light of the disclosure provided by Kitamura.

Consequently, Applicants respectfully assert that the invention described by independent claims 30, 41, and 50 is patentably distinguishable over Kitamura. As such, claims 35 and 38 depending from and further limiting patentable independent claim 30, claims 46, 47, and 49 depending from and further limiting patentable independent claim 41, and claim 53 depending from and further limiting patentable independent claim 50, are also

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patentably distinguishable over Kitamura for at least the reasons discussed above, and also for the additional limitations contained in each dependent claim.

**G. Rejection of Claims 31, 32, 36, 42, 43, 51, 52, and 54 under 35 U.S.C.**

**§ 103(a)**

The Examiner has rejected claims 31, 32, 36, 42, 43, 51, 52, and 54 as unpatentable under 35 U.S.C. § 103(a) for purported obviousness over Kitamura in view of Rinne. *See* page 13 of the Office Action. However, as discussed above, Applicants respectfully submit that the present invention, as defined by independent claims 30, 41, and 50, is patentably distinguishable over Kitamura. As such, claims 31, 32, and 36 depending from and further limiting patentable independent claim 30, claims 42 and 43 depending from and further limiting patentable independent claim 41, and claims 51, 52, and 54 depending from and further limiting patentable independent claim 50 are also patentably distinguishable over Kitamura, and Kitamura in combination with any other cited reference, such as Rinne, for at least the reasons presented above and also for the additional limitations contained in each dependent claim.

**H. Conclusion**

For all the foregoing reasons, Applicants respectfully submit that the present invention, as defined by independent claims 30, 41 and 50, and claims depending therefrom is patentably novel and inventive. Moreover, Applicants assert that no new

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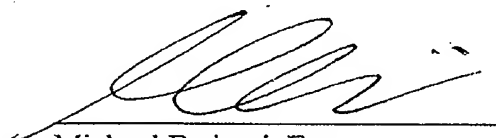
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matter has been introduced herein. Accordingly, Applicants respectfully request an early allowance of claims 30-32, 35, 36, 38, 41-43 and 46-54 pending in the present application.

The Commissioner is hereby authorized to charge payment of any additional fees associated with this communication, or credit any overpayment to Deposit Account No. 50-0731.

Respectfully Submitted,  
FARJAMI & FARJAMI LLP

Date: 12/23/10



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